EFEECT OF MASSED PRACTICE VERSUS DISTRIBUTED PRACTICE IN SKILL ACQUISITION AND RETENTION OF DISCRETE TASK PERFORMANCE AMONG COLLEGE STUDENTS

-An Experimental Study

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CERTIFICATE

This is to certify that research work entitled **"EFEECT OF MASSED PRACTICE VERSUS DISTRIBUTED PRACTICE IN SKILL ACQUISITION AND RETENTION OF DISCRETE TASK PERFORMANCE AMONG COLLEGE STUDENTS" -An Experimental study** was carried out by the candidate bearing the Register No: **27091609**, KMCH College of Physiotherapy towards partial fulfillment of the requirements of the **Master of Physiotherapy (Advanced PT in Neurology)** of the Tamil Nadu Dr. M.G.R. Medical University, Chennai-32.

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ABSTRACT

Extensive research has determined that new learning in healthy individuals is significantly improved when trials are distributed over time (spaced practice) compared to consecutive learning trials (massed practice). It has been shown to enhance free throw performance in college going student.

Aims

The purpose of this study was to analyze the effect of massed and distributed practice in skill acquisition and immediate retention of discrete task performance, whether learning in college going students is improved using a procedure.

Study design:

Pre test and post test experimental study design.

Procedure

Subjects were divided into two groups, massed practice and distributed practice. The subjects in both the groups were given 30 free throws. The subjects in the massed practice group were given 30 free throws on the same day. Pre test (before practice) and post test (acquisition) were taken on the same day. In distributed practice 30 throws were distributed over 3 days. Pre test (before

practice) was taken on the first day and post test (acquisition) to assess retention was taken after three days.

Results

The result of this study shows that, the Paired‘t’ test shows that acquisition of the discrete task improved among students who led both type of massed and distributed practice. Unpaired‘t’ test shows that both the practices have improved but massed practice had developed better acquisition skill than the distributed practice.

Conclusion

This study can be concluded that discrete task performance of free throws increase among both massed and distributed practice. That is, acquisition improves in both the type of practice. But, distributed type practice group maintained the learning when compare with the massed type of practice. That is acquisition is better in massed type of practice group and immediate retention is better is distributed type of practice group.

Keywords – Motor learning, Practice, Free throw performance.

1. INTRODUCTION

Motor learning has been traditionally referred as the study of the acquisition or modification of movement among normal subjects. It involves learning a new strategy for sensing as well as moving.

The principle in motor learning is that the degree of acquisition is dependent on the amount of practice[31]. Practice is just performing the same movement repeatedly. Even though, this is the most effective way to improve performance during the practice session itself, it is not optimal for retaining learning over a period of time[39]. Practice can be carried out in a number of ways that are more effective than blocked repetition of a single task (massed practice). A consistent finding throughout the literature is that introducing frequent and longer rest periods between repetitions (distributed practice) improves performance and learning. The other finding is that introducing task variability in the acquisition session improves performance in a subsequent session (retention) even though performance during acquisition may be worse than if the task were constant[32]. A common example is reaching to pick up a glass on a table. The therapist can either have the patient reach or grasp the same glass at a same distance repeatedly or have the patient pick up the glass at changing the speeds and distances. Even though, the patient may

reach for the glass better during the constant session, the patient reaches for the glass better at retention after the variable session.

Training subjects on a task repeatedly in the rehabilitation centre may lead to improved performance in that particular task but not transfer to any activities of daily living (ADL) when they get back home. Improvement with the treatment increases with the amount of training and relates mostly to the task practiced during therapy, with little generalization to other motor tasks. Thus, recovery is related to spontaneous biological. Thus, a process improves performance across a range of tasks whereas recovery mediated by training, like learning in healthy subjects, is more task-specific. These differences increase the important issue of true recovery and compensation and how they both relate to motor learning.

When learning a new skill, we are learning to control and co-ordinate multiple changes of freedom. Practicing a skill results in co-ordination pattern changes, we should expect a related change in the muscles, person uses while performing the skill. Vision plays an important role in the learning and control of skill. There are lot of stages from novice to expert. There are a number of individuals that have been presented to explain the individuals that have been presented to explain the stages that a learner goes through, and over the years, researchers have context in both the sport and rehabilitation context. It is vital that

any one engaged in teaching, coaching, or rehabilitation gains an understanding of these stages and considers the implications for skill acquisition.

Skilled movements are usually first undertaken using conscious, cognitively-driven control. Over a period of time, with practice, they are learned. Learning indicates information processing and the laying down of new neural pathways and connections that can be activated, when the specific movement pattern is required. These pathways are held in neural networks as a specific pattern of interconnections. Each set is a motor action that defines and executes a more-or-less specific pattern of specific muscle actions. When the brain is damaged by disease the networks may be disrupted, and at the same time the motor action plans disturbed or lost the function. Improvement after loss of neurological tissue will involve, restoring old or developing new motor action plans.

In motor learning theory, the assumption is that patients can improve with practice[15]. By practicing task specific and goal-oriented activities, researchers hypothesize that patients can possibly encourage cortical change through volitional movement. This brain plasticity, ability to change and adapt, is ultimately leads to “healing” in neurologic patients.

There are several types of rehabilitation techniques based on motor learning principles. One gaining more attention recently is Constraint-Induced Movement

Therapy. The basic principle of this treatment technique is to help patients to overcome learned non-use.

In Constraint-Induced Movement Therapy, the goal is to force the use of the involved limb using massed and shaping techniques. With the upper extremity, this is achieved by placing the unaffected limb inside a sling for 90% of waking hours over 2 weeks. The affected limb is then used repeatedly for 6-7 hours per day over these 2 weeks in a different exercises and activities. Use of the affected limb, there may be a functional reorganization in the undamaged motor cortex, possibly resulting in improved motor ability[40].

The key to tapping into the plasticity of the neurological system is to facilitate motor learning. “Practice makes man perfect.” It’s especially true for patients with neurological impairments that need motor learning.

We are becoming more aware of patients as active participants in practice rather than as passive audience of therapy. The idea that motor learning research can provide scientific information to guide clinical practice has been available to the profession for several years. Performance of an action which is effective in consistently achieving a specific goal with some economy of effort is said to be skilled. To know whether the performance has improved, the therapist measures the person’s performance at the start of practice at various stages throughout

rehabilitation and periodically after discharge to see whether or not performance gains have been maintained.

For several years, researchers have investigated the process of acquiring skill typically with healthy adults as they train to improve a specific skill and increasingly with people with neurological disability. As part of the training process, the therapist directs the patient's focus of attention away from an internal body orientation. Focus (the feet or upper body movement) should be to an external focus which is directly related to the goal (avoiding obstacles on the floor) [33]. .

In practicing functional tasks, the therapist sets the goals in consultation with the individual which is based on evaluation of the person's capabilities. As the therapist can analyse how a movement is organized based on knowledge of critical biomechanical characteristics; provide demonstration, verbal cues and feedback; direct the person's visual attention; or highlight regulatory cues in the environment (for example, the height of an obstacle). However, the patient should learn to organize movement that matches the environment in order to achieve these goals, and this is achieved by physical (and mental) practice. The environment should be organized to be functionally relevant by providing meaningful objects of variable sizes, weight and grasp ability, which allow for different tasks to be practiced.

Goals should be concrete rather than abstract: “Reach out and take the glass from the table” rather than “Raise your arm”. “Reach sideways to pick up the glass from the floor” rather than “Shift your weight over to the left”.

When the educational process is studied, the area of practice and its performance is a topic of interest. Therapist are invariably trying to find more efficient, successful methods of teaching motor skills to their students to improve learning, performance, and retention that are occurring[32]. Practice is an active process of attempting to perform a task, and it leads to the acquisition of skill. In order to be effective, practice trials usually need to be repeated many times. Increased practice of a task would enhance learning and skill acquisition in that task. “Skill” is a commonly used word which means an activity or task that has a specific purpose or goal to achieve. Motor skills and actions are similar terms that refer to goal-directed activities that involve voluntary head, body, and limb movements[23].

Practice can have both performance and learning effects on physical performance. Coaches are interested in employing those practice conditions which maximize the development of relatively permanent improvements in skill, that is, those that generate positive learning effects. Before individuals can become skilled in any activity, they must first acquire a basic movement repertoire, consisting of fundamental movement skills. Education involving movement skills should begin

at a young age, developing basic skills such as walking, throwing, catching, and climbing early which allows incorporating these skills. Skills that require object manipulation are more difficult to perform than skills that involve no object manipulation because the person must do two things at once. First, the person must manipulate the object correctly, and second, he or she must adjust body posture to accommodate for the imbalance created by the object.

When learning a skill it must be remembered that practice in one context must often be transferred and repeated in another context. When planning practice, regardless of whether this is in the sporting educational or rehabilitation context, the frequency of practice and the length of recovery has to be decided.

When practice is massed there is more time spent in work [actual practice] than in resting between the trials. When a greater amount of time is spent in the rest periods than in practice trials, it is called distributed practice. The phenomena associated with Practice distribution have been studied extensively in continuous tasks and discrete tasks. Continuous tasks are tasks with no discernable ending. Discrete tasks are tasks with discernable beginning and ending. Discrete tasks are characterized by rapid movements with very short movement times.

Over the years there has been a range of research that has explored the distribution of practice. Researchers have considered how massed, distributed, random, and blocked practice influence performance learning, retention and

transfer. Research in motor learning has shown that variations in practice scheduling may affect learning. Here we will look at two different factors; the amount of rest between practice trials [massed vs. distributed practice].

Hence, this study focused on effects of massed practice and distributed practice in skill acquisition and immediate retention of discrete tasks performance in college going students.

1.1 BACKGROUND OF THE STUDY

Carr JH, Shepherd RB et al 1987, Rehabilitation is predicated on the assumption that practice or training leads to improvement of skills. this underlying concept, study in motor control and motor learning has only begun to make an impact on the practice of rehabilitation. But, stroke rehabilitation has mainly focused either on passive facilitation of isolated movements or teaching patients to function independently using movement's alternative to the ones they used before their stroke[7].

In the recent years, understanding motor learning, neuroplasticity and functional recovery after the occurrence of brain lesion has grown significantly. Repeated motor practice and motor activity in a real world environment have been identified in several prospective studies as favourable for motor recovery in stroke patients (**Langhammer and Stanghelle et al, 2000**.)[19] Correspondingly, interventions and methods of physical exercise therapy in motor rehabilitation vary considerably depending on the physiotherapist's preferred therapeutic approach and on the patient's physical and motivational state. However, evidence-based strategies for motor rehabilitation are more and more available. The benefit of therapeutic strategies aiming at improving motor function in stroke patients has only been demonstrated on a general level, i.e. without specification of the

influence of a single well-defined intervention. **Hummelsheim and Eickhof et al (1999)**[12]**.**

As examples, the therapeutic techniques according to **Bobath et al, 1990** involves the reduction of an enhanced muscle tone (spasticity) before voluntary motor activities are facilitated. However, **Langhammer and Stanghelle et al, 2000,** pointed out that a task-specific "motor relearning program" is more effective with respect to motor recovery and to the level of independence in the activities of daily living as compared with the Bobath approach[19]. Task-specific and repeated practice regimens can induce lasting cortical reorganizations. **Classen et al, 1998,** that appear to precede motor improvement. The patients become gradually neuro- physiologically accustomed to exercise regimens to which they have been exposed repeatedly. An athlete executing the same training regimen until adaptation has occurred, we assume that many stroke patients experiencing plateaus may actually be adapting to their therapeutic motor exercise regimens. It seems that, when the cerebellum is damaged, motor learning is impaired and probably different from that in healthy subjects, but nevertheless possible. However, under which training conditions and to which extent motor learning is possible when the whole cerebellum or parts of it are damaged is still unclear and up to now there is no directive for an adequate, efficient and valid treatment of cerebellar

patients. Most human studies investigate short-term learning in a specific motor task in response to repetition. Rehabilitation of patients with cerebellar damage, however, requires a long-term learning process and the acquired motor patterns have to be transferred to everyday life[9].

Latash LP, Latash ML et al (1994), Skill is task-specific. Even though, such actions as level walking and stair walking May share similar biomechanical characteristics, the demands placed on the individual by each action are different. The individual learns reshaping and adaptation to the basic movement pattern according to different contexts. Thus, improvement in a specific action therefore requires practice of that action; that is, the learner practices to become effective and efficient in achieving a specific goal. For some individuals, speeding the actions and improving power generation may be major performance goals. But, for those muscle strength and motor control is below a certain threshold, such practice may not be possible. Various exercises which increase strength and control may be necessary, together with practice of the action under modified conditions, for example, standing up from a higher seat which requires less muscle force generation. Many repetitions of an action are needed to increase strength and for the patient to develop an optimal way of performing the action[20].

Winstein and colleagues tested the hemiplegic arm in patients with middle cerebral artery territory infarctions using an extension-flexion elbow reversal task

on a horizontal surface with feedback given as knowledge-of-results. The researchers found no difference in acquisition on day 1 or recall on day 2 between patients and controls although patients were less accurate overall[41]. **Fits P.M and Posner et al** concluded that The motor learning definition stresses the importance of achievement of new motor skill, improvement of previously learned motor skill or re-attainment of skills that are difficult to perform or cannot be performed due to injury or disease, changes that occur at neurological or performance levels as a result of motor learning and the factors influencing these changes are of particular interest for the rehabilitation of motor disorders. **Van Cranenburg et al,** 2004, concluded that explicit or declarative learning methods are the starting points in most rehabilitation programs aimed at motor-skill learning in the cognitively unimpaired population. In general, with explicit learning people tend to pass through three stages in the acquisition of motor skills **(Fitts and Posner et al 1967).**

The first stage is the “cognitive stage” in which the focus is on understanding the task and developing strategies to perform it, requiring cognitive activity such as attention and executive functions. The second phase is the “associative stage” in which the learner has selected the best strategy and now begins to refine the skill. Here, cognitive aspects are less important. And finally,

the “autonomous stage” in which the skill becomes automatic, requiring a low degree of attention.

Variables like practice and feedback can be structured differently to enhance learning at each stage. **Schmidt and Wrisberg et al, 2000** concluded that fatigue plays an important role in learning but the next question is how to alternate practice with rest to maximize Learning in patients.

According to **Schmidt RA, Lee TD et al (2005),** the most fundamental principle in motor learning is that the degree of performance improvement is dependent on the amount of practice. Practice in short is just performing the same movement repeatedly. Even though this may be the most effective way to improve performance during session itself, it is not optimal for retaining learning over time. Hence, this study is focused on effect of massed and distributed practice in motor learning.

2. REVIEW OF LITERATURE

- **Ebbinghaus et al, 1885,** in his publication on human memory provided convincing empirical evidence that learning and memory are significantly improved when repeated trials are distributed over time (spaced repetitions) compared to consecutive learning trials (massed repetitions).
- **Hull et al, 1943,** he was the first to formally the effect of practice distribution on performance and learning. He found that given an equal number of trials, distributed practice for both cognitive and motor task produced better performance and skill acquisition than massed practice.
- **Ammons et al, 1950,** in this study seven different experimental groups, all of which performed 36, 20-s trials of pursuit tracking in Phase 1 of the experiment. The amount of time between trials determined the different experimental conditions, with the seven groups assigned to conditions in which the rest period between each trial was 0 s, 20 s, 50 s, 2 m, 5 m, 12 m, or 24 h. The relative effectiveness of these practice conditions was maintained all experimental groups now performed a series of 36 trials with no rest between trials. Moderate levels performed by the other distribution groups. Clearly, massed practice was a relatively ineffective practice schedule compared to the other practice conditions[2].

- **Adams and Reynolds et al 1954,** performed the classic experiment commonly cited to support the conclusion's that massing practice leads to a performance but not a learning decrement. Participants practiced the pursuit rotor task for 40 trials. Results of this study showed that after switching to a distributed schedule, subjects showed that immediately improvement and soon were performing similarly to the control group. These results concluded that massed practice only decreased the performance and did not influence the learning of this skill[1].
- **Bourne and Archer et al (1956),** in this study, five different groups of participants were compared. All groups had work periods of 30 seconds. In one group, they practised continuously for 21 trials (0-s rest group). For the other groups, each group had a different rest interval between work periods. One group had rest periods of 15 seconds, and the other three groups had rest periods of 30, 45, or 60 seconds. Bourne and Archer's findings were very clear: the longer the rest period, the better the performance[24].
- **Singer et al, (1965)** examined the effects of massed and distributed practice on subjects performing a novel basketball skill (i.e., bouncing a basketball off the floor and into a basket). He used four phases during the study (i.e., pre-test, practice, post-test, and retention test). Subjects in the study were put into groups of 40 that included: a massed practice group who shot 80

consecutive shots with no rest, distributed group who shot 4 sets of 20 shots with 5 minutes rest between sets, and a second distributed group who shot 4 sets of 20 with a 24- hour rest between sessions over four days. Results of this study found that skill acquisition was favourable for the second distributed group with respect to immediate learning. However, performance did not differ significantly between the first retention tests. But, on the final retention test, the first two groups of massed and distributed practice were found to be favourable. In the discussion of the results, Singer believed that "performance rather than learning was dictated by the condition practice[33]."

- **Paterson and Hallberg et al, 1965,** since practice does play such a prominent role in the learning of motor skills, it's essential that those charged with teaching these skills have a thorough understanding of the role played by the practice situation during practice.
- **Carron et al, 1967,** massed practice almost always is used for discrete tasks. Schmidt describes this best by writing: It is best to say that for these discrete tasks, such as shooting a basketball or fielding a baseball, there is no evidence that reducing the rest time through massed practice degrades learning, and it may even benefit learning[24].
- **Carron et al 1969,** In his study practiced a discrete hand eye coordination task that required them to pick up a small dowel from a whole turn it end for

end, and reinsert it in the hole as quickly as possible. One attempt equalled one trial. Which lasted on the average between 1.3 and 1.7sec.people in the massed practice condition had a maximum300- milli sec inter trial interval; whereas those in the distributed group had 5sec between trials. The results of this study shows that the massed practice schedule led to better performance during both the practice trials and the retention test, which participants performed two days after completing the practicing trials[24].

- **Stelmach et al, (1969)** studied the efficiency of motor learning with distributed and massed practice. He used 160 male volunteers who were systematically assigned to various groups. The subjects performed two gross motor tasks and all received the same amount of practice during the sessions. During the massed practice times, the subjects practiced continuously for 8 minutes while the distributed groups practiced with a 30-second work/30-second rest regimen. After the 8-minute trial, all groups received 4 minutes of rest. The groups were then placed in distributed practice schedules for 6 more additional trials. The study revealed that initially the Distributed practice regimen produced significantly favourable results. Yet, performance was similar for the groups after the 4-minute rest period. Thus, the author surmised that the type of practice did not affect learning. In fact, he believed

that learning was based on the number of trials instead of the type of practice[24].

- **Whitley et al (1970)** in his study, he separated the two groups of 30 college males 35 trials in either massed practice or distributed practice methods. Results showed that distributed practice was significantly better in performance but learning was significantly for both groups. The methods used in this motor learning study are applicable to the shooting methods used in basketball[36].
- **Whitley et al, (1970)** performed a similar study on fine motor tasks. He used 60 college-age males broken into two equal groups performing massed and distributed practice each. The subjects performed 25 trials of a foot tracking task under a massed or distributed practice schedule only. They would then rest 5 minutes then finish with 10 trials of a distributed work/rest schedule. The schedule of massed practice was 25 seconds of work with 5 seconds of rest. The distributed practice schedule was 25 seconds work followed by 35 seconds rest. Results of the study indicated that learning occurred during both groups; yet, no significant differences were noted for the groups. However, the author found that “performance was significantly favoured under the distributed practice condition.” The author concluded that

"performance rather than learning was affected by the type of practice condition."[36]

- **Murphree et al, (1971).** In this study, there were four groups: massed practice group (24 consecutive trials for 3 days), two distributed groups (practiced 12 times per day with rest intervals), and a control group (no trials practiced). The results of the study revealed that learning, measured by performance, was significantly higher for the distributed groups during the practice phrase. However, retention of the skill was significantly higher for the massed practice group. Thus, this experiment supported previous research that massed practice primarily affected performance and not learning[36].
- **Hintzman et al, 1974;** in the present study we compared the effects of massed versus distributed practice. In normal subjects, it has often been demonstrated that when repeated items are spaced during presentation, performance is better than when the repetitions occur on adjacent trials.
- **Austin et al (1975)** examined the effect of massed and distributed practice on the learning of a velocity task. Three groups were taken in the testing massed, distributed, and a control group. Each subject practiced 50 throws during a week. The massed group completed all throws on each Wednesday of the six week testing period. The distributed group practiced 10 throws on

each weekday, and the control group did not practice during the six weeks. Results showed the distributed practice better to the massed and control groups. Similar practice methods may be used to help improve free throw shooting accuracy in basketball.

- **Singer et al (1975)** believed that "warm-up will probably be more beneficial for those skills that require a great deal of precision. Timing, and coordination, especially if there is a long layoff from the last experience to the present event"[34]
- **Singer et al, 1975** stated that "practice is a necessary for learning a skill". Skills are developed by practice allowing the learner to form associations between stimuli and responses, and practice is more effective when undertaken in an organized manner, the utilization of practice with specific goals and guidelines seems logical for improving skill development[34].
- **Sage et al, 1977,** the massed practice method of free throw shooting may be preferred for learning if the subjects are highly motivated and top performance is needed.
- **Lawther et al, 1977,** this study showed that there improvement in both the massed and distributed practice groups, although the improvements in group had no statistical significance. Then observing the difference in the mean scores of the pre- and post-test, the distributed practice group had slightly

more improvement than that of the massed practice group. Once the means were adjusted by using the statistical treatment, the massed pract.ice group showed the increase in improvement over the distributed practice group.

- **Burt McDonald et al, 1980,** fifth and sixth grade boys (N = 38) participated in the free throw study to examine the effects of massed and distributed practice during a 10-session experimental program. Ss were randomly assigned to two groups: amassed practice group (n: = 19). And a distributed practice group (n =- 19). The massed practice group practiced 20 consecutive free throws during each session. The distributed practice group practiced 20 free throws, attempted two free throws then waited until every other subject. In this sub group had attempted two free throws before taking his next turn. An AN0VA produced P >0.05 between the massed practice free throw shooting method and the distributed practice free throw shooting method. Results of using the adjusted mean scores indicated that the massed practice group showed the greater increase in improvement over the distributed practice group.
- **Annet and piech et al 1985,** in his study found that two 5- trial training sessions separated by one day led to better training of a computer target-shooting game than one 10-trial sessions. One trial shooting at 10singly presented moving targets researchers assessed learning by a performance test

given one day after the end of the training sessions. The distributed group not has more hits on the test but also has error in the shooting attempts.

- **Bouzid and crawshaw et al 1987,** in these study researchers showed that for the learning of word processing skills. Typist who practiced twelve skills during two sessions of 35 and 25min each, separated by a 10 min break required less time to learn the skills and had fewer errors on a test than typists who practiced the skills during one 60 min sessions.
- **Lee and Genovese et al,1988,** the advantage of distributed over massed practice on performance at the end of practice is constantly large over experiments, they also, suggested that distributed practice conditions resulted in better learning than massed practice condition.

Merely observing and thinking about a motor skill will not work in the acquiring of a high level of skill. Skilful responses are developed only through repetition of the desired Movement pattern and improvement occurs only if conscientious attempts to improve are made[34].

- **Wek & Husak et al, 1989,** one notable exception was a small study of children with autism in which no significant Differences were found between massed and distributed practice schedules on motor performance and learning.

- **Schmidt, et al 1991,** this study distribution effect on learning, he gave all of their participants a 5 minutes rest period following the last trial. After the rest period, participants were asked to perform the task under a massed condition (all trials were performed with 0-s rest periods of 30s of work. The results showed that groups that had initially practised with some rest between trials still performed better than the group that had practised with no rest. The finding suggests that precise distribution had a relatively permanent effect, which is supported by the literature [19,34].
- **Schmitz et al, 1991,** however, the most of massed and distributed practice research had involved continuous skills analogous to real world tasks such as swimming or cycling and termed continuous tasks. Schmitz pointed out that the principles governing the effects of massed and distributed practice are different for 'discrete and continuous' tasks ([19.34].
- **Laird S. Cermak et al, 1996,** this study showed the effects of repetition and spacing of repetitions on amnesia patients Recognition and recall of a list of words. Like controls, amnesia patients recognized items better when repetitions were distributed compared with when they were massed. These results were attributed to the additional rehearsal that distributed presentations typically encourage. Amnesia patient also showed normal spacing effects in a recall task, suggesting that they were able to benefit from

the variable encoding that spaced repetitions allow establishing additional retrieval cues. Although, the instructions to encode the repeated items in a variable manner, enhanced massed presentations to the point where spacing no longer produced an advantage for the normal controls[17].

- **Baddeley et al, (1999),** he provides more evidence about the superiority of distributed practice effect on learning over massed practice. He points out that it is better to distribute learning trials across a period of time than to mass them in a single period. In a study conducted to teach a large number of postmen to type, he grouped them into four different practice schedules: an intensive group with two two-hour sessions per day, intermediate groups involve either one two-hour or two one-hour sessions per day, and more relaxing group which involves one one-hour session of typing per day. The results show that the group who worked for one-hour a day learned the keyboard on fewer hour of training and improved their performance more rapidly than the other three groups. He indicated that they learned in 55 hours as much as the four-hours per day group learned in 80 hours. They appeared to continue to improve at a faster rate. When tested after several months, the one-hour per day group retained their skill better than the four-hours per day group. These results show that distributed practice is more efficient and better for learning[4].

Both massed and distributed practice can profit the learning of free throw shooting accuracy. The distributed practice of free throw shooting uses short interval periods of rest during practice. During these rest periods mental practice may take place. Distributed practice may be helpful in free throw shooting accuracy for immediate performance[33].

- **Schmitz et al, 1999,** the amount of rest between the trials equals or exceeds the amount of time in a trial". When the practice is distributed .thus, it seems that the defining detail of distributed practice is that rest is "distributed "during the trials[20].Since practice does play such a prominent role in the learning of motor skills, it is essential that those charged with teaching these skills have a thorough understanding of the role played by the practice situation during practice[20].
- **DeLuca, et al 2000,** they determined that when the amount of information acquired during the learning trials is controlled (i.e., both individuals with TBI and healthy adults reach a Predetermined criterion), subjects with TBI recall and recognize information at a level Comparable to healthy adults. These findings imply that the primary memory deficit Following TBI involves acquiring, or learning, new information. As a part of these conclusions, clinical interventions with patients with TBI should be geared toward enhancing their ability to acquire, or learn, new information[11].

- **Hillary et al, 2003** they concluded from their studies that individuals with moderate-severe TBI demonstrated significantly improved word list recall following spaced versus massed presentations of targeted words. Spaced retrieval (i.e., expanded rehearsal) is form of distributed practice that provides individuals with severe memory loss practice at successfully recalling information over expanded time intervals. Successful recall for prolonged time periods is thought to enhance the ‘‘durability’’ of learning[11].
- **Son et al (2004)** found that individuals tended to mass their practice on Items that were hard to remember but spaced their practice on easy items. The decision to mass or space practice trials, of course, is based on metacognitive judgments and could fall prey to the same illusions-of-competence problems as discussed previously. Nevertheless, there does appear to be some advantage for learning when the individual is given some control over their learning environment[34].
- **Kristina S et al, 2005** this study suggests that massed practice may be useful to improve upper extremity function in individuals with SCI. Furthermore, it suggests that the combination of massed practice and somatosensory stimulation results in greater increases in pinch strength and timed functional test scores than massed practice training alone. Such a combination may be a beneficial rehabilitation technique to improve strength and function in

individuals with incomplete cervical SCI. It is recommended that a randomized controlled study be conducted to investigate the effects of these interventions with a larger sample size, as well as to investigate the effect of somatosensory stimulation alone on cortical plasticity and function in individuals with SCI[17].

- **Yan-hua Huang, 2009,** potential Predictors of Motor and Functional Outcomes after Distributed Constraint-Induced Therapy for Patients with Stroke, in this study concluded that The best predictor for motor outcomes after distributed CIT was greater motor ability of the distal part of the upper extremity, which is consistent with the presence of residual motor pathways that may respond to training. The FMA may be of value to form patients for their likelihood to use from distributed CIT protocols[45].
- **Dettmers C, Teske U et al,2007** massed and distributed training in Constraint-induced therapy involves restraint of the unaffected UE (eg, during 90% of the hours the patient is awake per day for 2 weeks), forcing the use of the affected UE (eg, 6 h/d on 10 consecutive weekdays), and massed task-related training of the affected UE.3 Because the acceptance of CIT among therapists and patients remains poor due to prolonged practice and restraint,4 different forms of CIT have been developed[43].

3. AIM AND OBJECTIVES

3.1 AIM OF THE STUDY

To analyse the effect of massed and distributed practice in skill acquisition and immediate retention of discrete task performance among college going students.

3.2 OBJECTIVES OF THE STUDY

To evaluate the effect of massed practice in discrete task performance among college going students.

To evaluate the effect of distributed practice in discrete task performance among college going students.

To compare the effect of discrete task performance between massed practice and distributed practice among college going students.

3.3OPERATIONAL DEFINITION-

- **Motor learning**

  Motor Learning is a change in the capability of a person to perform a skill that must be inferred from a relatively permanent improvement in performance as a result of practice or experience or experience. Schmidt (1991).

- **Skill**

  Skill is an activity or task that has a specific purpose or goal to achieve, an indicator of quality of performance.R.Magill.2001

- **Motor skill**.

  Activities or tasks that require voluntary head, body, limb movement to achieve a goal. R.Magill.(2001)

- **Discrete motor skill**

  Motor skill clearly defined movement beginning and end points, usually requiring a simple movement. R.Magill.(2001)

- **Massed practice**

  Defines massed practice more loosely as, “a practice schedule in which the amount of rest between trials is short relative to the trial length. Schmidt (1991)

- **Distributed practice**

  Defines distributed practice is “a practice schedule in which the amount of rest between practice trials is long relative to the trial length” (Schmidt, 1991)

4. MATERIALS AND METHODOLOGY

4.1Study design

Pre and Post Test Experimental study design.

4.2 Study setting

Basketball court, NGP Arts and Science College, Coimbatore-14.

4.3 Sample size

20 subjects

4.4 Study population

In group A-10 College going students to be trained by massed practice.

In group B- 10 College going students to be trained by distributed practice.

4.5 Sample selection

Purposive sampling

4.6 CRITERIA FOR SELECTION:-

4.6.1 Inclusion criteria

- Age 18-22 years
- Gender Male

- Height 165-178 cm
- `Right handed dominant students

4.6.2 Exclusion criteria

- Basketball players, experts, school players.
- Muscle strain and ligament sprain
- Open wound over the hand.
- Cognitive deficit

4.7 Study duration

- Five days for a massed practice group (A)
- Seven days for a distributed practice group (B)

4.8 HYPOTHESIS

4.8.1 NULL HYPOTHESIS

H_{o1}-There is no significant effect of massed practice in improving skill acquisition and immediate retention on free throw performance among college going students.

H_{o2}-There is no significant effect of distributed practice in improving skill acquisition and immediate retention on free throw performance among college going students.

H_{o3}-There is no significant difference between massed practice and distributed practice in improving skill acquisition and immediate retention on free throw performance among college going students.

4.8.2 ALTERNATE HYPOTHESIS

H_{a1}-There is significant effect of massed practice in improving skill acquisition and immediate retention on free throw performance among college going students.

H_{a2}-There is significant effect of distributed practice in improving skill acquisition and immediate retention on free throw performance among college going students.

H_{a3}-There is significant difference between massed practice and distributed practice in improving skill acquisition and immediate retention on free throw performance among college going students.

4.9 STUDY PROTOCOL:-

All subjects were assessed in order to ensure that all of them meet the required selection criteria.

The subjects were given information about the training and informed consent was obtained before the experiment.

4.10 PROCEDURE

This study was carried out in Basketball court of NGP Arts and Science College, Coimbatore.

Participants

The subjects were 20 college students. The subjects were randomly assigned to one of the two groups.

Experimental task

In this study, basketball free throw is selected and it is chosen as skilled task to study the effect of two types of practice. A free throw is an unguarded shot that a player takes from the foul line of a basketball court. The foul line is the line fifteen feet from the backboard and parallel to the end line from which player shoot free throws.

The subjects were divided into two groups.

In the **Pre-test**, twenty shots were given to all subjects. The subjects should shoot the free throws in any style they prefer from the foul line while another subject rebounds and returns the ball to the shooter. No help or coaching was given to the subjects. Pre- test (Before practice) data were collected in both the groups.

Group A is massed practice without rest interval. One by one the entire subjects complete the thirty shots while other subjects rebound and return the ball to the shooter.(As shown in picture 4.11.4).

The subjects in the massed practice perform thirty shots in one day practice session without rest intervals. Immediately after the practice session Post- test (acquisition) of group A was measured. Retention trial is measured after three days by using free throw test no practice sessions after the post test data collection.

Group B is distributed practice group. The subjects in this group shoot a total of ten shots with rest intervals between each two shots as per the instruction(As shown in picture 4.11.5).One subject performs two shots while another subjects rebounds the ball. At the completion of two shots, the subjects exchange positions until both subjects have completed ten shots each likewise all the subjects completed the task. The inter trial rest intervals are not kept constant because of the subject's individual rate of performance.

The subjects in the distributed practice perform thirty shoots finished in three days practice sessions with ten shots each day. Immediately after the practice session completed Post- test (acquisition) of group B were taken. Retention trial is measured after three days by using free throw test with no practice sessions after the post test data collection.

INSTRUCTIONS:-

WARM-UP EXERCISE (10 MINUTES)

- Jogging: starting at one end of court (forward, backward; defensive sliding).
- Dribbling, passing and moving the ball in pairs and moving side line to side line.
- Stretching: Calf's, hamstrings, hip adductors, quadriceps and arms stretching.

PREPARATION PHASE (As shown in picture 4.11.1)

- see target (basket)
- feet shoulder width apart
- toes straight
- knees flexed
- shoulders relaxed
- non shooting hand under ball
- shooting behind the ball
- thumb relaxed
- elbow in flexed
- Ball between head and shoulder.

ACTION PHASE (As shown in picture 4.11.2)

- See target (Basket)
- Extend legs, back and shoulders
- extend elbow
- flex wrists and fingers forward
- release ball off index finger
- balance hand on ball until release(as seen in figure2)

RECOVERY PHASE (As shown in picture 4.11.3)

- see target (Basket)
- arm extended
- index finger points to target
- shooting hand palm down
- Balance hand palm up.(as seen in figure3)

COOL DOWN EXERCISE (10 MINUTES)

- Jogging: starting at one end of court (forward, backward; defensive sliding).

Stretching: Calf’s, hamstrings, hip adductors, quadriceps and arms.

4.11 PHOTOGRAPHIS ILLUSERATION

picture 4.11.1 preparation phase

Picture 4.11.2 action phase

Picture 4.11.3

Picture 4.11.4- MASSED PRACTICE

Picture 4.11.5-DISTRIBUTED PRACTICE

4.12 OUTCOME MEASURE

FREE THROW SHOT TEST

The tasks of ten free throws from the foul line are selected.

The shots are scored for-

- four points given for a clean shot,
- three points for a rim in or out,
- two points for a backboard in or out,
- One point for a complete miss.

4.13 STATISTICAL ANALYSIS:-

The paired‘t’ test was used to find out the significance of each group Before practice and acquisition and retention values.

FORMULA-

PAIRED `t’ TEST: (within groups)

$$t = \frac{\bar{d}\sqrt{n}}{S}$$

Where,

$$\mathbf{S} = \sqrt{\frac{\sum \boldsymbol{d^2} - \left[\bar{\boldsymbol{d}}\right]^2 \times \boldsymbol{n}}{\boldsymbol{n-1}}}$$

UNPAIRED `t’ TEST: (between groups)

The unpaired‘t’ test was used to compare the statistically significant difference of pain between Group A & B subjects.

$$t = \frac{\overline{X1} - \overline{X2}}{S} \sqrt{\frac{n_1 n_2}{(n_1 + n_2)}}$$

Where,

$$S = \sqrt{\frac{\sum d_1^2 + \sum d_2^2}{n_1 + n_2 - 2}}$$

S=combined standard deviation

d_1&d_2 =difference between initial & final readings in group A &group B respectively.

n_1&n_2=number of patients in group A & group B respectively.

$\overline{X}_1$&$\overline{X_2}$ =Mean of group A & group B respectively.

5. DATA PRESENTATION

5.1 TABULATION

TABLE 5.1.1 - PAIRED 't' TEST VALUES BETWEEN BEFORE PRACTICE AND ACQUISITION AMONG MASS PRACTICE GROUP.

PERFORMANCE	MEAN ± SD	MEAN DIFFERENCE	CALCULATED 't' VALUE
BEFORE PRACTICE	25.3± 0.307	4.7	4.8
ACQUISITION	30 ± 0.307		

Level of significance- p <0.05 *

The before practice and acquisition values of free throw test in massed practice Group A is analysed by paired 't' test for the performance.

The table't' value at the level of 5%significance and for 9degrees of freedom is 1.833 and the calculated't' value is 4.8.As the calculated 't' value is higher than the table't' value, the null hypothesis rejected(H_{o1}). Hence, alternate hypothesis accepted (H_{a1}) that there is significant effect of massed practice in improving skill acquisition and immediate retention on free throw performance among college going students.

TABLE 5.1.2 - PAIRED 't' TEST VALUES BETWEEN ACQUISITION AND IMMEDIATE RETENTION AMONG MASS PRACTICE GROUP.

PERFORMANCE	MEAN	MEAN DIFFERENCE	CALCULATED 't' VALUE
ACQUISITION	30± 0.384	3.7	3.04
IMMEDIATE RETENTION	26.3±0.384		

Level of significance- $p < 0.05$ *

The acquisition and immediate retention values of free throw test in massed practice Group A is analysed by paired't' test for the performance.

The table't' value at the level of 5%significance and for 9degrees of freedom is 1.833 and the calculated t value is 3.04.As the calculated't' value is greater than the table't' value, the null hypothesis rejected(H_{o1}). Hence, alternate hypothesis accepted(H_{a1}) that there is significant effect of massed practice in improving skill acquisition and immediate retention on free throw performance among college going students.

TABLE 5.1.3 - PAIRED 't' TEST VALUES BETWEEN BEFORE PRACTICE AND ACQUISITION AMONG DISTRIBUTED PRACTICE GROUP.

PERFORMANCE	MEAN	MEAN DIFFERENCE	CALCULATED 't' VALUE
BEFORE PRACTICE	23.3±0.159	4.1	8.09
ACQUISITION	27.4±0.159		

Level of significance- $p < 0.05$ *

The before practice and acquisition values of free throw test in distributed practice group is analysed by paired 't' test for the performance.

The table't' value at the level of 5%significance and for 9degrees of freedom is 1.833 and the calculated 't' value is 8.09.As the calculated 't' value is greater than the table't' value, the null hypothesis rejected (H_{02}) Hence, the alternate hypothesis (H_{a2}) is accepted. That there is a significant effect of distributed practice in improving skill acquisition and immediate retention on free throw performance among college going students.

TABLE 5.1.4- PAIRED 't' TEST VALUES BETWEEN ACQUISITION AND IMMEDIATE RETENTION AMONG DISTRIBUTED PRACTICE GROUP.

PERFORMANCE	MEAN	MEAN DIFFERENCE	CALCULATED 't' VALUE
ACQUISITION	27.4±0.3486	0.3	0.36
IMMEDIATE RETENTION	27.1±0.3486		

Level of significance- p >0.05

The acquisition and immediate retention test values of free throw test in distributed practice group is analysed by paired't' test for the performance.

The table 't' value at the level of 5%significance and for 9 degrees of freedom is 1.833 and the calculated 't' value is 0.36.As the table 't' value is greater than the calculated 't' value, the alternate hypothesis rejected(H_{a2}) Hence, null hypothesis accepted(H_{02}) That there is no significant effect of distributed practice in improving skill acquisition and immediate retention on free throw performance among college going students.

TABLE 5.1.5- UNPAIRED 't' TEST VALUES BETWEEN MASSED PRACTICE GROUP AND DISTRIBUTED PRACTICE GROUP.

PERFORMANCE	MEAN VALUES		CALCULATED 't' VALUE
	GROUP A	GROUP B	
BEFORE PRACTICE	25.3± 0.264	23.3± 0.264	1.67
ACQUISITION	30± 0.208	27.4± 0.208	2.77
IMMEDIATE RETENTION	26.3±0.299	27.1±0.299	0.596

Significance for before practice:

Level of significance – $p > 0.05$

Significance for acquisition:

Level of significance – $p < 0.05$*

Significance for immediate retention:

Level of significance – $p > 0.05$

Before practice values of free throw test between Group A and Group B

For 8 degrees of freedom at 5 % level of significance, the table ‘t’ value is 1.860 and the calculated ‘t’ value is 1.67.As the calculated ‘t’ value is less than the table ‘t’ value, the null hypothesis (H_{03}) is accepted. Thus, there is no significant difference between massed practice and distributed practice in improving skill acquisition and immediate retention on free throw performance among college going students.

Acquisition values of free throw test between Group A and Group B-

For 8 degrees of freedom at 5 % level of significance, the table ‘t’ value is 1.860 and the calculated ‘t’ value is 2.77.As the calculated ‘t’ value is more than the table ‘t’ value, the alternate hypothesis (H_{a3}) is accepted. Thus, there is a significant difference between massed practice and distributed practice in improving skill acquisition and immediate retention on free throw performance among college going students.

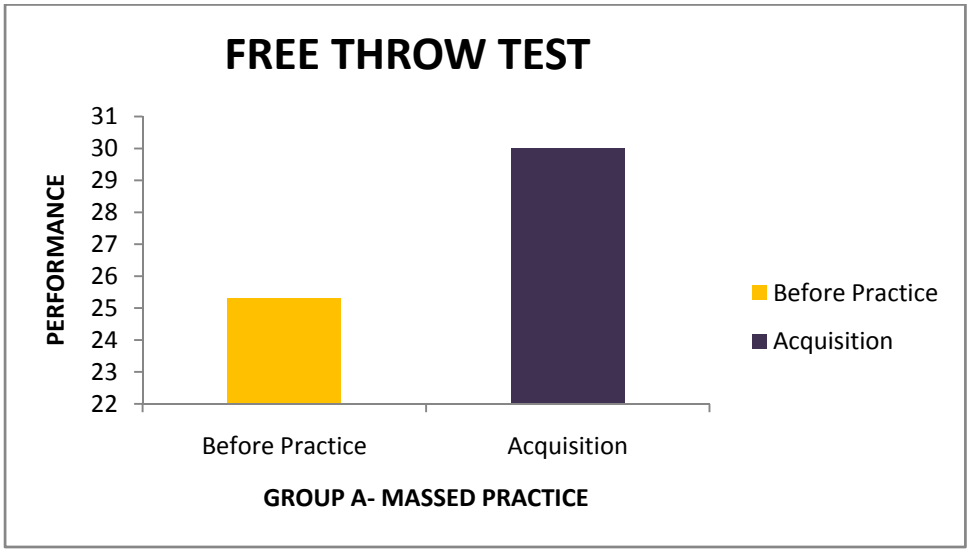
Immediate Retention values of free throw test between Group A and GroupB

For 8 degrees of freedom at 5 % level of significance, the table ‘t’ value is 1.860 and the calculated ‘t’ value is 0.596.As the calculated ‘t’ value is less than the table ‘t’ value, the null hypothesis (H_{o3}) is accepted.

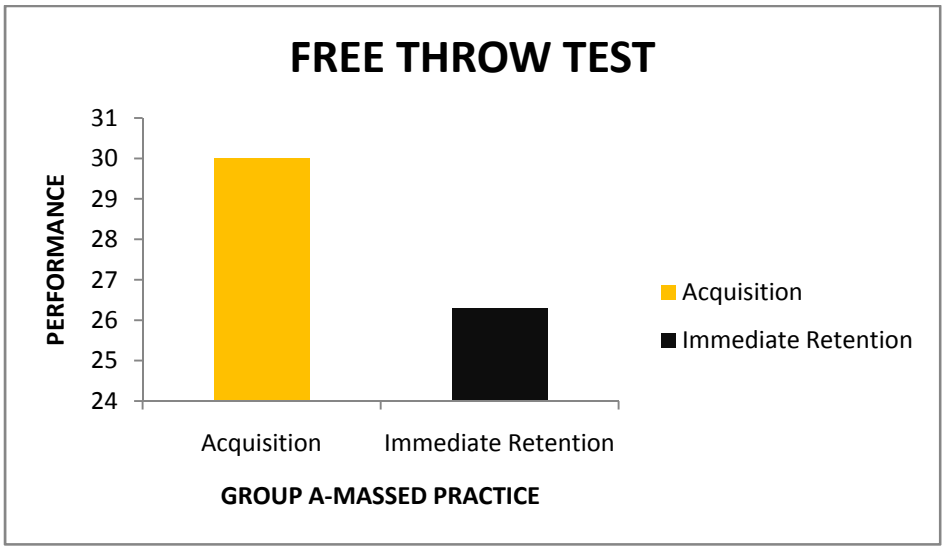
Thus, there is no significant difference between massed practice and distributed practice in improving skill acquisition and immediate retention on free throw performance among college going students.

5.2 GRAPHICAL PRESENTATION

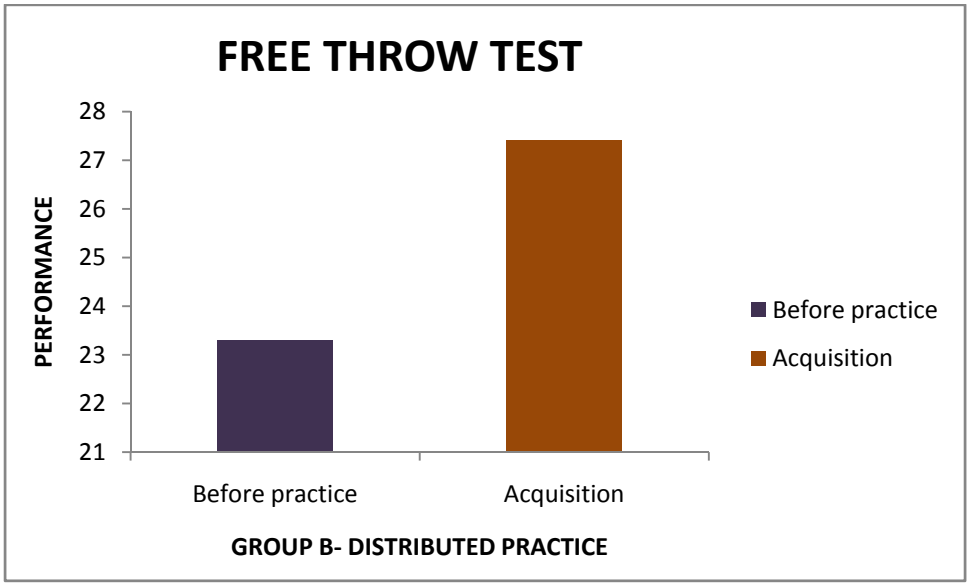
5.2.1 - Mean values of free throw performance before practice and acquisition among massed practice group.



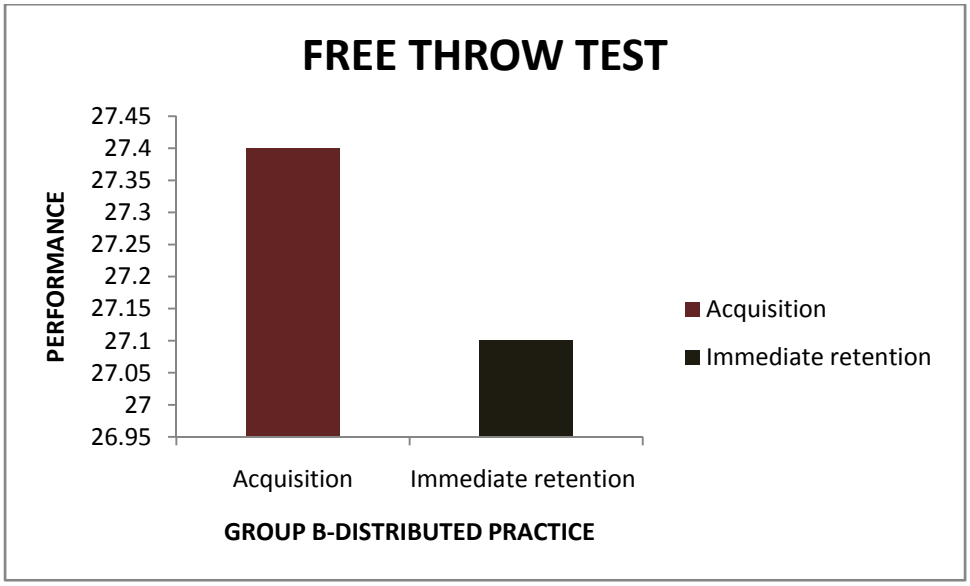
5.2.2 - Mean values of free throw performance acquisition and immediate retention among massed practice group.



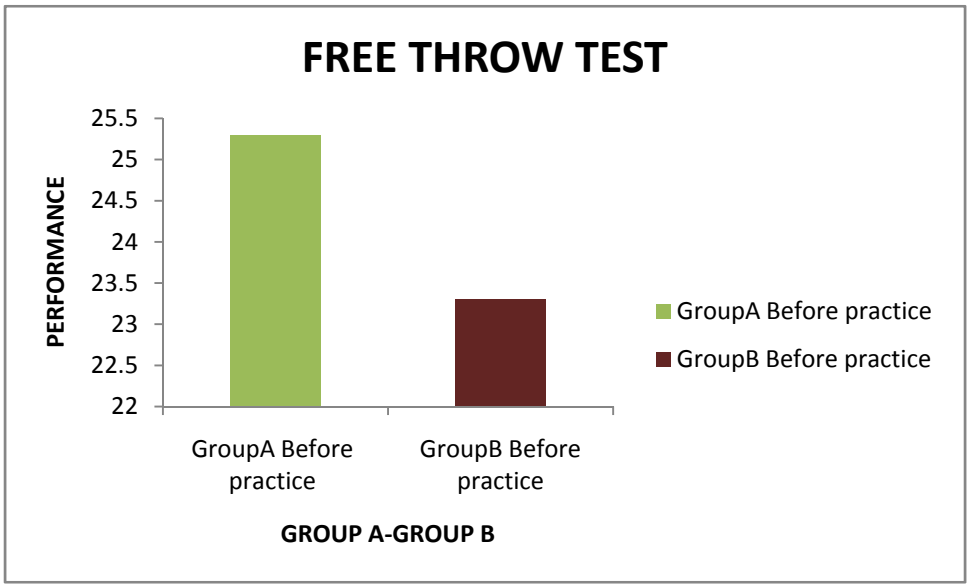
5.2.3 Mean values of free throw performance before practice and acquisition among distributed practice group.



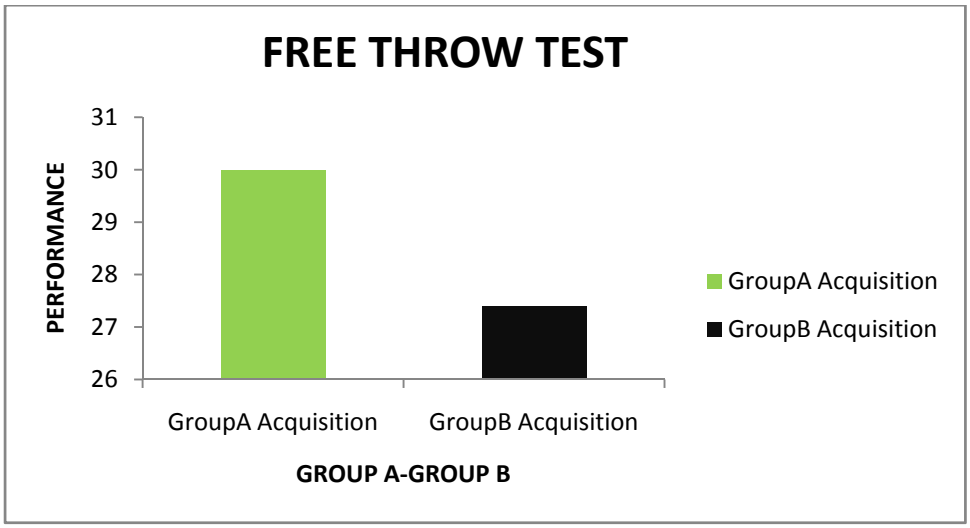
5.2.4 Mean values of free throw performance acquisition and immediate retention among distributed practice group.



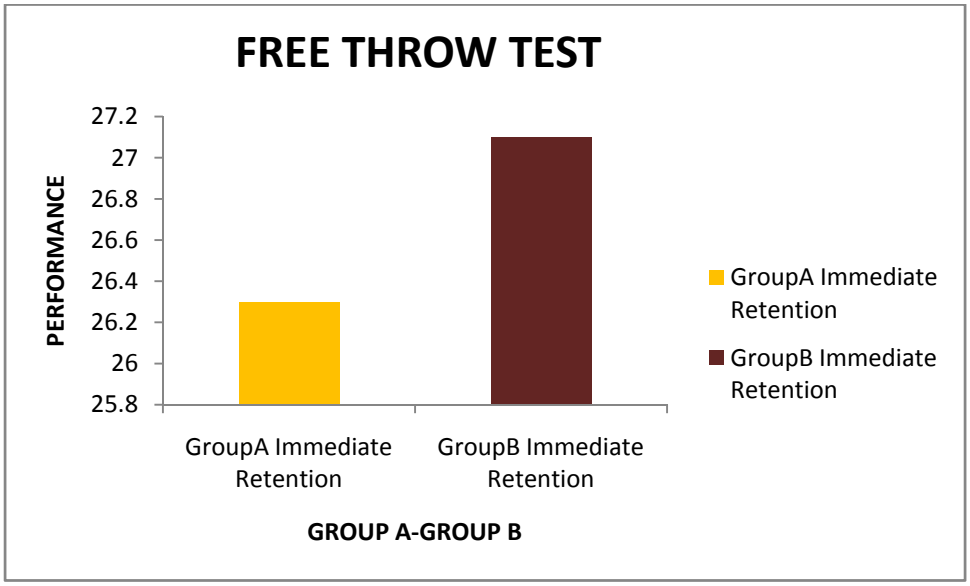
5.2.5 Comparison of mean values of Before practice between Massed Practice group and Distributed Practice group.



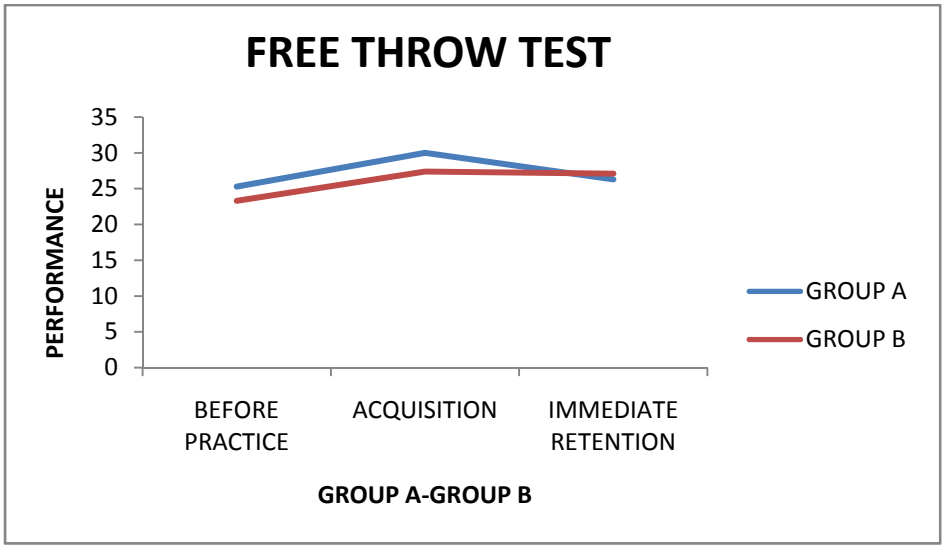
5.2.6 Comparison of mean values of Acquisition between Massed Practice group and Distributed Practice group



5. 2.7 Comparison of mean values of immediate retention between Massed Practice group and Distributed Practice group



5.2.8 Mean values of free throw performance before practice and acquisition and immediate retention



6. DATA ANALYSIS AND RESULTS

The changes within the massed practice group and distributed group are analysed using paired‘t’ test. The difference between the groups were analysed using unpaired ‘t’ test.

Group-A massed practice group Paired ‘t’ test - Values between Before practice and acquisition.

Before practice and Acquisition values of group A results showed that the calculated‘t’ value is 4.8 at the level of 5%significance for 9 degrees of freedom and the ‘t’ table value is 1.833.As the calculated ‘t’ value is higher than the table ‘t’ value, the alternate hypothesis (H_{a1}) is accepted. Hence, that is there is significant effect of massed practice in improving skill acquisition and immediate retention on free throw performance among college going student.

Paired‘t’ test values between acquisition and immediate retention.

Acquisition and Immediate retention values of group A results showed that the calculated ‘t’ value is 3.04 at the level of 5%significance for 9 degrees of freedom and the ‘t’ table value is 1.833. As the calculated ‘t’ value is higher than the table ‘t’ value, alternate hypothesis(H_{a1}) is accepted thus, that is There is

significant effect of massed practice in improving skill acquisition and immediate retention on free throw performance among college going students.

Group B Distributed practice group Paired‘t’ test values between the Before practice and acquisition.

Before practice and Acquisition values of group B showed that the calculated ‘t’ value is 8.09 at the level of 5%significance for 9 degrees of freedom and the ‘t’ table value is 1.833.As the calculated ‘t’ value is higher than the table ‘t’ value, the alternate hypothesis (H_{a2}) is accepted. Thus, there is significant effect of distributed practice in improving skill acquisition and immediate retention on free throw performance among college going students.

Paired‘t’ test values between acquisition and immediate retention

The acquisition and immediate retention values of group B the calculated ‘t’ value is 0.36 at the level of 5% significance for 9 degrees of freedom and the ‘t’ table value is 1.833.As the calculated ‘t’ value is less than the table ‘t’ value, that is (H_{O2}) null hypothesis accepted. Thus, there is no significant effect of distributed practice in improving skill acquisition and immediate retention on free throw performance among college going students.

Unpaired ‘t’ test

Before practice values of Group A and Group B showed that, For 8 degrees of freedom at 5 % level of significance, the table‘t’ value is 1.860 and the calculated ‘t’ value is 1.67.As the calculated ‘t’ value is less than the table ‘t’ value, the null hypothesis (H_{o3}) is accepted. Thus, there is no significant difference between massed practice and distributed practice in improving skill acquisition and immediate retention on free throw performance among college going students.

Acquisition values of Group A and Group B showed that, For 8 degrees of freedom at 5 % level of significance, the table ‘t’ value is 1.860 and the calculated ‘t’ value is 2.77.As the calculated ‘t’ value is more than the table ‘t’ value, the alternate hypothesis (H_{a3}) is accepted. Thus, there is a significant difference between massed practice and distributed practice in improving skill acquisition and immediate retention on free throw performance among college going students.

Immediate Retention values of Group A and Group B showed that, for 8 degrees of freedom at 5 % level of significance, the table‘t’ value is 1.860 and the calculated ‘t’ value is 0.596.As the calculated ‘t’ value is less than the table ‘t’ value, the null hypothesis (H_{o3}) is accepted. Thus, there is no significant difference

between massed practice and distributed practice in improving skill acquisition and immediate retention on free throw performance among college going students.

Paired‘t’test shows that acquisition of the discrete task improved among students who led both type of massed and distributed practice. Unpaired‘t’ test shows that both the practices have improved but massed practice had developed better acquisition skill than the distributed practice.

7. DISCUSSION

Massed practice and distributed practice mostly involved in learning of free throw shooting performance. The distributed practice method of free throw shooting uses short interval periods of rest during practice. During these rest periods mental practice may take place **(Schmidt et al, 1991)**[30].

The build-up of fatigue has been shown to have a slight negative effect on learning **(Lee & Genovese et al, 1988)** in massed practice[20]. **Schmidt et al, 1991**, found that it is "good to explain to the learner that even though fatigue may come during practice, participants are still learning effectively." In addition, the student also should be informed that the learning gained during the fatigue will become evident in the future after the fatigue reduced[30].

Distributed practice may be helpful in free throw shooting accuracy for immediate performance **(Singer et al, 1975)**[33]. The massed practice method of free throw shooting may be preferred for learning if the subjects are highly motivated and top performance is needed **(Sage, 1977).** The massed practice can also reach higher levels of learning sooner than distributed practice **(Lawther, 1977). Schmidt et al,1991** describes It is best to say that for these discrete tasks, such as shooting a basketball ,there is no evidence that reducing the rest time through

massed practice degrades learning, and it may even benefit learning in some cases[30].

This study consisted of 20 college going students. The students were selected based on the inclusion and exclusion criteria and randomly assigned into 2 groups. Group A massed practice and Group B distributed practice. Outcome measure used was free throw test to measure the individual free throw performance, before practice and immediate acquisition and immediate retention values were taken. Aim of this study is to analyse the effectiveness of massed practice and distributed practice of a discrete task performance in motor learning.

The result of this study shows that there is improvement in both the massed and distributed practice groups. Then observing the difference in the mean scores of the acquisition and immediate retention, the distributed practice group had maintained the learning than that of the massed practice group.

Hence, this study includes two important methods of practice that is massed and distributed practice. Both the practice has widely used in the neurological rehabilitation in the physiotherapeutic aspects of a training the individual or patients to improve their disabilities or impairments.

In this study, both the practices have showed their significance improvement in the discrete task performance and learning.

8. SUMMARY AND CONCLUSION

In this study, we analyse the effect of massed practice and distributed practice improving on an acquisition and immediate retention in college going student. Students were selected and assigned into two groups, one group receiving massed practice and another group receiving the distributed practice.

The study is a pre-test and post-test experimental design. The results are analysed using‘t’ test. The results show significant improvement in massed practice and distributed practice.

CONCLUSION-

From this study, it can be concluded that discrete task performance of free throws increased among both massed and distributed type of practice. That is, acquisition improves in both the type of practice. But, distributed type practice group maintained the learning when compare with the massed type of practice. That is acquisition is better in massed type of practice group and immediate retention is better is distributed type of practice group for discrete task performance.

9. LIMITATIONS AND SUGGETIONS

This study is done on the small sample size. Further research will be done in the large sample size.

This study was done in the college going students. Further research must be done in the neurological population and continuous skill and sports people and school students.

Study was tested by seven days. This study should be tested for long days.

New technique in neurological physiotherapy must be tested by varying methods of practice.

During early rehabilitation the effectiveness of varying type of practice must be study.

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APPENDIX I

DATA PERFORMA

Name

Age

Gender

Height

Basketball player

Open wound in the hand

Any muscle strain and ligament sprain

Cognitive deficit

APPENDIX- II

INFORMED CONSENT TO PARTICIPATE IN THE RESEARCH STUDY

I _____ voluntarily consent to participate in the research study, **"EFEECT OF MASSED PRACTICE VERSUS DISTRIBUTED PRACTICE IN SKILL ACQUISITION AND RETENTION OF DISCRETE TASK PERFORMANCE AMONG COLLEGE STUDENTS" -An Experimental study**

The researcher has explained to me about the research in brief, the risk of participation and has answered the questions related to the research to my satisfaction.

Signature of the applicant:

Signature of the researcher:

Signature of the witness: **Date:**